CLAIMS

1. An optoelectronic memory comprising:

an information-storage medium that can be locally and reversibly switched between at least two optical states by application of electrical fields; and

an information-storage-layer-optical-state detection means that detects and reports the optical states of regions of the information-storage medium.

2. The optoelectronic memory of claim 1 wherein the information-storage-layer-optical-state detection means further includes:

a detector layer within the information-storage medium that responds differently to an interrogating signal depending on the optical state of the information-storage medium; and

a read/write device that applies the interrogating signal to regions of the information-storage medium and generates a reporting signal based on a response of the detector layer.

3. The optoelectronic memory of claim 2 wherein the detector layer responds to an electromagnetic-radiation-based interrogation signal that is transmitted through the information-storage medium, when the information-storage medium is in a first optical state, and that is not transmitted through the information-storage medium, when the information-storage medium is in a second optical state.

4. The optoelectronic memory of claim 2 wherein the detector layer responds to an electromagnetic-radiation-based interrogation signal that is transmitted through the information-storage medium by generating an electric current.

5. The optoelectronic memory of claim 2 wherein the read/write device applies an electromagnetic-radiation-based interrogation signal to regions of the information-storage medium, detects whether or not the detector layer generates an electric current in response to the applied electromagnetic-radiation-based interrogation signal, and returns an electric-current or electric-voltage signal when the detector layer generates an electric current in response to the applied electromagnetic-radiation-based interrogation signal.

6. An optoelectronic memory device comprising:

an information-storage medium that includes an information-storage layer that can be locally and reversibly switched between at least two optical states by application of electrical fields;

a detector layer within the information-storage medium that can detect whether or not an applied electromagnetic radiation beam is transmitted through the information-storage medium at different positions of the information-storage medium; and

a read/write device that applies electrical fields to write information into the information-storage layer and that applies electromagnetic-radiation beams in order to read information stored in the information-storage layer.

7. The optoelectronic memory device of claim 6 wherein the information-storage layer comprises a two-dimensional optical state-change organic polymer having a relatively rigid, fused-ring, organic-dye-based planar network and acetylene-linked rotatable molecular components.

8. The optoelectronic memory device of claim 7 wherein the rotatable molecular components can be rotational oriented by application of an electrical field.

9. The optoelectronic memory device of claim 8 wherein the rotatable molecular components can be stably oriented in a rotational position coplanar with the relatively rigid, fused-ring, organic-dye-based planar network, leading to a fully conjugated organic-dye-based two-dimensional polymer that absorbs and/or reflects electromagnetic radiation of a particular frequency range, and wherein the rotatable molecular components can be stably oriented in a rotational position approximately orthogonal to the relatively rigid, fused-ring, organic-dye-based planar network, leading to a not-fully conjugated organic-dye-based two-dimensional polymer that is transparent to electromagnetic radiation of the particular frequency range.

10. The optoelectronic memory device of claim 6 wherein the information-storage medium includes:

a first, information-storage layer comprising a two-dimensional optical state-change organic-polymer film that can be locally, stably, and reversibly switched between a first optical state that absorbs or reflects electromagnetic radiation of a particular frequency and a second optical state that is transparent to electromagnetic radiation of the particular frequency;

a second, electrode layer that is transparent to electromagnetic radiation of the particular frequency; and

a third, photodiode detector layer that, when illuminated by electromagnetic radiation of the particular frequency, generates a current.

11. The optoelectronic memory device of claim 10 wherein the read/write device applies an electrical field of a first polarity to a small region of the first, information-storage layer to induce the first optical state within that region to represent a first binary value, applies an electrical field of a second polarity to a small region of the first, information-storage layer to induce the second optical state within that region to represent a second binary value, and illuminates a small region of the first, information-storage layer in order to access information stored in the information-storage layer by detecting whether or not the photodiode detector layer generates an electrical current in response to the illumination.

12. A method for storing a bit of information, the method comprising

providing an optoelectronic memory device that includes an information-storage medium with an information-storage layer that can be locally and reversibly switched between at least two optical states by application of electrical fields and that includes a detector layer within the information-storage medium that can detect whether or not an applied electromagnetic radiation beam is transmitted through the information-storage medium at different positions of the information-storage medium;

when the bit of information has a first binary value, applying an electrical field of a first polarity to a small region of the first, information-storage layer to induce the first optical state within that region; and

when the bit of information has a second binary value, an electrical field of a second polarity to the small region of the first, information-storage layer to induce the second optical state within that region.

13. The method of claim 12 further comprising:

subsequently illuminating a small region of the information-storage layer in order to access information stored in the information-storage layer by detecting whether or not the photodiode detector layer generates an electrical current in response to the illumination.

14. The method of claim 12 wherein the information-storage layer comprises a two-dimensional optical state-change organic polymer having a relatively rigid, fused-ring, organic-dye-based planar network and acetylene-linked rotatable molecular components.

15. The method of claim 14 wherein the rotatable molecular components can be stably oriented in a rotational position coplanar with the relatively rigid, fused-ring, organic-dye-based planar network, leading to a fully conjugated organic-dye-based two-dimensional polymer that absorbs and or reflects electromagnetic radiation of a particular frequency range, and wherein the rotatable molecular components can be stably oriented in a rotational position approximately orthogonal to the relatively rigid, fused-ring, organic-dye-based planar network, leading to a not-fully conjugated organic-dye-based two-dimensional polymer that is transparent to electromagnetic radiation of the particular frequency range.

16. A method for constructing an optoelectronic memory, the method comprising:

providing an information-storage medium that can be locally and reversibly switched between at least two optical states by application of electrical fields; and

using an information-storage-layer-optical-state detection means to detect and report the optical states of regions of the information-storage medium.

17. The method of claim 17 wherein the information-storage-layer-optical-state detection means further includes:

a detector layer within the information-storage medium that responds differently to an interrogating signal depending on the optical state of the information-storage medium; and

a read/write device that applies the interrogating signal to regions of the information-storage medium and generates a reporting signal based on a response of the detector layer.

18. The method of claim 18 wherein the detector layer responds to an electromagnetic-radiation-based interrogation signal that is transmitted through the information-storage medium, when the information-storage medium is in a first optical state, and that is not transmitted through the information-storage medium, when the information-storage medium is in a second optical state.

19. The method of claim 18 wherein the detector layer responds to an electromagnetic-radiation-based interrogation signal that is transmitted through the information-storage medium by generating an electric current.

20. The method of claim 18 further including:

applying an electromagnetic-radiation-based interrogation signal to regions of the information-storage medium, using the read/write device, to detect whether or not the detector layer generates an electric current in response to the applied electromagnetic-radiation-based interrogation signal; and

returning an electric-current or electric-voltage signal when the detector layer generates an electric current in response to the applied electromagnetic-radiation-based interrogation signal.